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Description

Improved Apparatus, System and Method for Dispensing Paper from a Paper Roll

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is a continuation the U.S. designation and election of pending application PCT/US03/15291 filed May 16, 2003; which in turn is a continuation-in-part of U.S. application 10/063,841 filed May 17, 2002, now abandoned.

BACKGROUND OF THE INVENTION

[0002] This invention relates generally to the field of writing implements such as pens and pencils combined with papers sources, and particularly to improving the mechanism by which paper is dispensed from the barrel of such a combined writing implement, or from a similar dispenser.

[0003] Devices combining a writing implement with a paper source have long been known in the art. One of the earliest such combined devices is disclosed in U.S. Patent 640,543, which discloses a rolled strip of paper inside a tubular pencil case. Since then, a wide variety of combined writing implement and paper holding devices have sought to improve upon the basic ideas and mechanisms of U.S. 640,543. These include U.S. 1,359,725; 1,431,722; 2,005,110; 2,073,719; 2,076,035; 2,081,036; 2,224,470; 2,601,650; 3,963,358; 4,327,875; 4,872,775; 4,963,048; 5,024,547; 5,158,384; 6,135,661; Des. 329,459; Des. 346,619; and Des. 338,036.

[0004]

U.S. 1,322,966 varies the idea of combining paper and a writing implement by placing a paper roll *outside* the writing implement as a separate attachment. U.S. 2,111,362 adds a rolled calendar to the basic writing implement. U.S. 2,301,364

discloses a pencil with a booklet contained therein. U.S. 2,517,445 dispenses a rolled ticker tape. U.S. 3,552,869 dispenses rolled stamps. U.S. 2,287,618 dispenses rolled toilet tissue. U.S. 4,030,842 discloses a flexible sheet which is extended from and retracted into a writing implement for storing information.

[0005] Several of these patents, for example, U.S. 1,431,722 and 2,512,168 also disclose a ratcheting or similar one-way mechanism to prevent paper from being rolled back into the writing implement once it has been unrolled out of the writing implement, which is generally desirable unless one of the goals is to roll the paper back into the writing implement, as is the case when the paper roll is used to store information (e.g., for the calendar of U.S. 2,111,362).

[0006] Helpful summaries of much of this prior art are provided in U.S. 4,812,069; 4,963,048; and 6,135,661.

[0007] One of the most important operational aspects of a combined writing implement / paper dispenser is the mechanism for dispensing the paper out from the writing implement. It is important to simultaneously prevent the paper from unrolling inside of the writing implement, while also making it easy for the paper to unroll when it desired to dispense paper from the writing implement. Many of the patents noted above disclose mechanisms for dispensing paper which are prone to undesired jamming or tearing of the paper, are difficult to load or unload, require complex threading of the paper, do not enable easy dispensation of the paper, and / or are extremely complex from a mechanical and cost-of-production standpoint. Some of what appear to be the more complex dispensing mechanisms among the patents cited earlier include those disclosed in U.S. 2,073,719 (see, e.g., Fig. 4); 2,224,470 (see, e.g., Fig. 4); 2,287,618 (see, e.g., Fig. 5); 2,601,650 (see, e.g., Figs. 14-18); 3,963,358 (see, e.g., Fig. 13); and 4,812,069 (see, e.g., Fig. 6).

[0008] One of the problems is that in the above patents, the paper roll itself is unsecured at

its ends, and thus tends to unravel inside the pen, especially as the paper supply is depleted and the paper has more room inside the pen barrel to unroll. This problem is partially resolved by U.S. 1,266,299 to Moore, which uses a roll that has scores proximate its edges (along the line b') and is glued together along its edges (outside of the line b'). U.S. 2,512,168, also to Moore, uses a scoring similar to that of U.S. 1,266,299, but wherein the scoring converges as one approaches the center of the roll.

[0009] While this does help to secure the edges of the paper to prevent unraveling, it does not address the issue of how to peel off the outer layer of paper from the inner layers when it is desired to dispense some paper from the writing implement. Especially as the paper supply depletes, the outer surface winding of the rolls disclosed in U.S. 1,266,299 and 2,512,168 (and indeed, of the rolls in all of these patents) resides further from the edge of the writing implement barrel and the slot through which the paper is pulled, and it becomes more and more difficult the get the paper edges to protrude through the dispensing slot. Indeed, the basic problem is that as the roll is depleted, it becomes more important to secure the roll in such a way that it will not unravel inside the writing implement, and yet, by securing the roll precisely when it is depleted and thus its outer surface is further from the slot, it then becomes harder to "leaf off" the outer edge of the paper, through the slot.

[0010] It would therefore be desirable to have a simple mechanism for dispensing rolled paper from the barrel of a writing implement (or from a paper roll dispenser generally) that simultaneously secures the paper roll from unrolling inside the barrel while "leafing" up the outermost layer of the paper roll through the barrel slot for easy dispensation, especially when the paper supply is largely depleted.

SUMMARY OF INVENTION

[0011] A paper roll dispensing apparatus in accordance with the invention comprises outer winding separation and inner winding restraint means for restraining inner windings

of the paper roll from unrolling while simultaneously separating an outer winding of said paper roll from its inwardly-adjacent winding, and tension-supplying means for pressing a restraining edge of the outer winding separation and inner winding restraint means against an outside layer of the paper roll, both when the paper roll is substantially full and as the paper roll becomes depleted.

[0012] Preferably, the paper roll also comprises tack adhesive means for adhering successive windings of the paper roll to one another when the outer winding is not pulled away from its inwardly-adjacent winding and simultaneously enabling the adhesion to be broken without substantial tearing of the paper when the outer winding is pulled away from its inwardly-adjacent winding. An embodiment in which induced curling of the paper is used to facilitate dispensing is also disclosed.

BRIEF DESCRIPTION OF DRAWINGS

[0013] The features of the invention believed to be novel are set forth in the appended claims. The invention, however, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawing in which:

[0014] Fig. 1 is a mixed perspective and schematic view of a paper roll barrel for use in connection with, e.g., writing implements, in a preferred embodiment of the invention using a paper roll with tack adhesion.

[0015] Fig. 2 is a cross sectional view if Fig. 1 taken along the line 2—2, when the paper roll is relatively full.

[0016] Fig. 3 is the same cross sectional view as is Fig. 2, but is taken when the paper roll is relatively depleted.

[0017] Fig. 4 is a mixed perspective and schematic view of a paper roll barrel for use in connection with, e.g., writing implements, in an embodiment of the invention using a

paper roll with tearable lines.

[0018] Fig. 5 is a mixed plan and exploded perspective view illustrating a non-limiting, mechanically-based exemplary implementation of a tension-supplying means that aids in both restraining and separating paper from the paper roll in accordance with the invention.

[0019] Figs. 6-8 are perspective views illustrating a paper roll assembly for use in all embodiments of the invention, but particularly for the embodiment illustrated in Figs. 10-13.

[0020] Figs. 9-11 are perspective views illustrating a curl-inducing dispenser case employed in an embodiment of the invention in which induced curling of the paper is used to facilitate dispensing.

[0021] Figs. 12-13 are perspective and schematic cross-sectional views respectively, illustrating the dispensing of paper in the curl-inducing embodiment.

DETAILED DESCRIPTION

[0022] Fig. 1 shows a paper roll dispenser **1** barrel in a preferred embodiment. Dashed lines are used to show visually-hidden elements. Dispenser case **102** comprises a paper roll dispensing aperture **104**, similarly to the slots used in much of the prior art referenced above. Also similarly to the prior art, residing inside of dispenser case **102** is a paper roll **106**. In a preferred embodiment, the successive paper windings of paper roll **106** are secured to one another preferably along their outer ends using a tack adhesive means **108** for providing sufficient adhesion between said successive windings when a leading edge **110** of paper roll **106** is not pulled away from its inwardly-adjacent windings and simultaneously enabling said adhesion to be broken without substantial tearing of the paper when leading edge **110** (i.e. the outermost winding) of paper roll **106** is pulled away from its inwardly-adjacent windings. (Please note that while tack adhesion along the outer ends is preferred,

as will be discussed, the tack adhesive can in fact be used in other locations as well.) Quite suitable for tack adhesive means **108** is any adhesive means similar in character to the adhesive used in commonly-used Post-It® Notes, which allows successive sheets of paper to adhere to one another in a pad while awaiting use, and allows sheets to be removed from the pad without substantial tearing when said sheets are gently pulled away from the pad. In an alternative embodiment illustrated in Fig. 4, the paper ends are scored or similarly weakened for tearing along tearable lines **402**, and are glued together along their outside edges using any suitable general adhesive means **404** for adhering said successive windings to one another, including adhesives stronger than tack adhesive means **108** which may thus **not** allow for separation from one winding to the next without tearing along tearable lines **402**, similarly to the paper roll used in U.S. 1,266,299.

[0023] As in some of the prior art, paper roll **106** is dispensed through dispensing aperture **104** by rotating (**112**) paper roll **106** about its rotational axis **114** relative to dispenser case **102**. Rotating **112** can be achieved by a variety of means known in the art including by rotating a spindle **116** running through rotational axis **114** of paper roll **106** using any suitable rotating means **118** such as the illustrated end cap with a spindle receptacle **120** mating with spindle **116**. It is preferred, though not required, that rotating **112** be restricted to one direction only as schematically illustrated by the directional arrows on **112**, using any of a variety of directional rotation restriction means known in the art for enforcing such one-way rotation. Even more preferably, rotating **112** should be fully unrestricted in one direction (the "unrolling" direction as illustrated), and restricted to a fractional part of a full rotation in the other ("rolling") direction. This allows unrestricted unrolling, but allows a user to roll the paper back up through, for example, not limitation, a quarter or eighth or sixteenth of a rotation but not any further for fine adjustments as may be needed from time to time.

[0024] Now, as discussed earlier, one problem in the prior art is that if successive windings of paper roll **106** are not secured to one another, preferably at their ends, the paper tends to unravel inside the pen, especially as the paper supply is depleted and the paper has more room inside dispenser case **102** to unroll. That is why it is preferred to employ tack adhesive means **108** as shown in Fig. 1, or alternatively tearable lines **402** in combination with general adhesive means **404** as shown in Fig. 4. But, as also discussed, this, by itself, does not address the issue of how to peel off the outer layer of paper from the inner layers when it is desired to dispense some paper from the writing implement, especially as the paper supply depletes and the outermost surface winding resides further from dispenser case **102** and dispensing aperture **104**. That is, this addresses how to prevent the paper from unrolling when it is desired that the paper *not* unroll. But it does not address how to ensure that the leading edge **110** (i.e., the outermost winding) of the paper roll *will* unroll when it is desired to have this leading edge **110** unroll.

[0025]

To resolve this problem, Figs. 1, 2, 3 and 4 also discloses an outer winding separation and inner winding restraint means **122** for simultaneously restraining the inner windings from unrolling while causing the outer winding to separate from its inwardly-adjacent winding, in combination with tension-supplying means **124** for causing said outer winding separation and inner winding restraint means **122** to flex inward toward the rotational axis **114** as the paper supply is depleted. As a result of this tension-supplying means **124**, a restraining edge **126** of outer winding separation and inner winding restraint means **122** will *always* press against the outside layer **128** of paper roll **106**, both when paper roll **106** is full, and as paper roll **106** becomes depleted. At the same time, because leading edge **110** is threaded *outside* outer winding separation and inner winding restraint means **122**, the placement of outer winding separation and inner winding restraint means **122** between leading edge **110** and outside layer **128** will always cause the outermost

winding to separate from the rest of paper roll **106** as paper roll **106** is rotated in the unrolling direction. This is seen by contrasting Figs. 2 and 3. In Fig. 2, when paper roll **106** is substantially full, outer winding separation and inner winding restraint means **122** is angled such that its restraining edge **126** is further from rotational axis **114**, while in Fig. 3, when paper roll **106** is relatively depleted, outer winding separation and inner winding restraint means **122** is angled such that its restraining edge **126** is closer to rotational axis **114**. In all cases, outer winding separation and inner winding restraint means **122** is angled such that its restraining edge **126** presses against outside layer **128** of paper roll **106**. Note also the preferred (but not required) concave curvature of outer winding separation and inner winding restraint means **122** as viewed from rotational axis **114**.

[0026] Finally, it is to be observed that once a desired length of paper has been dispensed, this desired length is severed from paper roll **106** by tearing against a cutting edge **130** of dispensing aperture **104**, as is the case in much of the prior art discussed above. (Cutting edge **130** may contain a blade (with due consideration for safety), serrations, or any similar reasonable paper severing means known in the art for safely effecting such severing.)

[0027] After severing, leading edge **110** will reside proximate cutting edge **130** and will not protrude substantially out of dispensing aperture **104**. It is important for leading edge **110** to remain proximate dispensing aperture **104** after severing so that it will be accessible next time it is desired to dispense more paper. It is thus to be observed from the cross-sectional Fig. 2 that there is an overlap region **202** through which outer winding separation and inner winding restraint means **122** overlaps with a region of dispenser case **102** adjacent cutting edge **130**. In Fig. 2, overlap region **202** circumscribes an approximately 30 degree overlap angle with a fairly full roll, but this overlap angle can be varied as desired to be any angle greater than 10 degrees and any angle less than 120 degrees for a full paper roll, recognizing that

this angle will decrease slightly as the roll is depleted and outer winding separation and inner winding restraint means **122** becomes more sharply angled relative to dispenser case **102**. If the concave curvature of outer winding separation and inner winding restraint means **122** is suitably chosen, the overlap angle can be made a large as 180 degrees, so that outer winding separation and inner winding restraint means **122** actually spirals around part of the paper roll. The preferred magnitude of this overlap angle is greater than 15 degrees, and less than 75 degrees, with an optimum minimum of 30 degrees and an optimum maximum of 60 degrees. So long as leading edge **110** remains within overlap region **202** after severing, it will in fact remain accessible for when it is next desired to dispense more paper.

[0028] In the event that rotating **112** is optionally restricted to a fractional part of a full rotation in the "rolling" direction as noted earlier, using suitable one-directional rotation restriction means known or obvious in the art for allowing free rotation in the unrolling direction while restricting the rotation in the rolling direction, the fractional rotation allowed in the restricted direction should be less than the angle of overlap region **202** for an empty paper roll **106**. This ensures that once the paper is severed, the severed edge of the paper will always remain within overlap region **202** between outer winding separation and inner winding restraint means **122** and dispenser case **102**, and cannot be wound back into the roll past restraining edge **126**. This in turn ensures that the leading edge **110** of paper roll **106** is always in optimum position for dispensing, the next time such dispensing is desired. Thus, if overlap angle **202** is, say, 45 degrees (i.e., one eighth of a full revolution) for a full paper roll (the state of affairs in Fig. 2), then any back-winding allowed in the restricted direction should be less than 45 degrees.

[0029] However, even if back-winding (turning in the winding direction) is completely unrestricted (which is allowable but less preferred), it will always be possible to bring leading edge **110** out through dispensing aperture **104** simply through forward

winding (turning in the unwinding direction). In particular, even if leading edge **110** is wound all the way back, the fact that restraining edge **126** always presses against the outside layer **128** of paper roll **106** no matter how full is paper roll **106** will cause restraining edge **126** to "leaf" under leading edge **110** as paper roll **106** is wound forward in the unwinding direction and peel it back off from the remainder of paper roll **106**. Once this occurs, further forward winding through the angle of overlap region **202** will naturally cause leading edge **110** to emerge from dispensing aperture **104**.

[0030] Because tension-supplying means **124** presses restraining edge **126** of outer winding separation and inner winding restraint means **122** against outside layer **128** of paper roll **106**, both when paper roll **106** is substantially full as in Fig. 2 and as paper roll **106** becomes depleted as in Fig. 3, paper roll **106** is effectively restrained from unrolling inside of dispenser case **102**, even in the absence of tack adhesive means **108** (Fig. 1) or general adhesive means **404** combined with tearable lines **402** (Fig. 4). However, when tack adhesive means **108** or general adhesive means **404** combined with tearable lines **402** are included as well, then the paper roll **106** itself inherently will not unroll unless it is actively encouraged to do so, and so one does not need to depend exclusively upon outer winding separation and inner winding restraint means **122** to prevent this unrolling inside of dispenser case **102**.

[0031] In Fig. 1, while tack adhesive means **108** is illustrated along the outer ends of paper roll **106**, tack adhesive means **108** can in fact be located at other points too, including in the middle regions of paper roll **106**. Indeed, tack adhesive means **108** can cover substantially the *entirety* of paper roll **106**, since restraining edge **126** is designed to "leaf" under leading edge **110** as paper roll **106** is wound forward in the unwinding direction and peel leading edge **110** back off from the remainder of paper roll **106**. The use of tack adhesive means **108** in regions other than, or in addition to, the outer ends of paper roll **106**, provides additional assurance that paper roll

106 will not unroll inside of dispenser case 102, and that leading edge 110 will only leaf off when it is desired to leaf it off. Further, in the Fig. 1 embodiment, restraining edge 126 is preferably designed to press against the entire length of paper roll 106, *including* the tack adhesive 108 regions, since the paper will separate without substantial tearing along the tack regions as well as the non-tack regions.

[0032] This is one of the benefits of using the tack adhesive means 108 of Fig. 1 over the general adhesive means 404 combined with tearable lines 402 of Fig. 4. Particularly, in the Fig. 4 embodiment, where actual tearing takes place and there is no tack adhesive, one really is constrained to securing the paper from unwinding only along its edges. The use of general adhesive means 404 combined with tearable lines 402 in other regions of paper roll 106 would cause tearing along those other regions, which would not be desirable unless one *wanted* to tear the paper into two or more strips. Also note that in the Fig. 4 embodiment, restraining edge 126 must be designed to only press against and leaf under the non-adhered regions of paper roll 106, since the adhered regions do **not** separate and leafing under these regions would thus not be desirable. In other words, for the Fig. 4 embodiment, restraining edge 126 is located to press against the outside layer 128 of paper roll 106 only in regions of paper roll 106 where successive windings are not adhered to one another. In the Fig. 1 embodiment, restraining edge 126 may be located to press against the outside layer 128 of paper roll 106 in at least one region of paper roll 106 where successive windings **are** adhered to one another. While recognizing that the embodiment of Fig. 1 is thus preferred, the embodiment of Fig. 4 nevertheless remains an acceptable embodiment.

[0033] As a general rule, it is desirable to design paper roll dispenser 1 to accept either type of paper roll, i.e., either the Fig. 1 or the Fig. 4 type paper roll 106. Thus, of one sticks to using a tack or general adhesive along only the outer ends of paper roll 106, restraining edge 126 should be designed to only press against and leaf under

the non-adhered regions of paper roll **106**, so that either type of paper roll may be employed.

[0034] At this point, we turn to examine tension-supplying means **124** in some further detail. From a functional viewpoint, the key purpose of tension-supplying means **124** is to supply tension to press restraining edge **126** of outer winding separation and inner winding restraint means **122** against the outside layer **128** of paper roll **106**, both when paper `roll **106** is substantially full and as paper roll **106** becomes depleted. Any tension-supplying means **124** which achieves this functional objective is considered to be within the scope of this disclosure and its associated claims, and it is for this reason that tension-supplying means **124** is *schematically* illustrated in Figs. 1 through 4 with a "spring" coil next to a circular "hinge."

[0035] Fig. 5 now illustrates a specific, non-limiting, exemplary implementation of tension-supplying means **124**, which is mechanically-based. In this implementation, one uses an actual spring in which the spring tension is supplied, not by the stretching of the spring, but by the curling of the spring about its longitudinal axis. The mechanism operates similar to a door hinge that not only allows for the door to rotate thereabout, but also supplies a spring tension that causes the door to automatically close when the door is not being purposefully held open. Thus, outer winding separation and inner winding restraint means **122** is attached to dispenser case **102** via a hinge proximate spring **124**, and spring **124** itself pushes outer winding separation and inner winding restraint means **122** toward the rotational axis **114** via outer spring armatures **501** which press against dispenser case **102** and outer winding separation and inner winding restraint means **122** so as to exert a force in the direction of the unnumbered directional arrows in Fig. 5. While the spring shown in Fig. 5 "pushes" against dispenser case **102** and outer winding separation and inner winding restraint means **122**, one could with equal ease within known art use the spring to "pull" dispenser case **102**, and / or to "pull" outer

winding separation and inner winding restraint means **122**. Indeed, for a mechanical implementation of tension-supplying means **124**, wherein tension-supplying means **124** comprises mechanical means for pressing restraining edge **126** against said outside layer **128** of paper roll **106**, any form of spring-type hinge known in the art is considered to be within the scope of this disclosure and its associated claims, irrespective of the nature of the source of the spring tension, irrespective of where it is located along or with respect to the hinge, and irrespective of the precise nature of the hinge.

[0036]

While the implementation of Fig. 5 is *mechanically* based, it is to be clearly understood that tension-supplying means **124** can also be *materially* based. Particularly, there are a broad range of flexible materials known in the materials arts which can be bent somewhat out of shape, and which will spring back to their original state when the force causing the bending is later removed. For example, not limitation, this includes a wide range of flexible plastics, spring-steels, rubberized materials, mylar, and similar materials. Thus, it is to be understood that outer winding separation and inner winding restraint means **122** may be constructed, in whole, or in part (particularly proximate where outer winding separation and inner winding restraint means **122** joins with dispenser case **102**), out of a material that serves the functional objective of supplying tension to press restraining edge **126** of outer winding separation and inner winding restraint means **122** against the outside layer **128** of paper roll **106**, both when paper roll **106** is substantially full and as paper roll **106** becomes depleted. An outer winding separation and inner winding restraint means **122** that is materially based can be fabricated in a unitary manner together with dispenser case **102**, or can be fabricated as a separate component that is then attached to dispenser case **102**. In either event, outer winding separation and inner winding restraint means **122** comprises tension-supplying means **124**; and tension-supplying means **124** comprises materially-based means

for pressing restraining edge **126** against outside layer **128** of paper roll **106**. It is again to be understood that such a materially-based implementation, in addition to or alternatively to a mechanically-based implementation, is encompassed by the schematic illustration of tension-supplying means **124** in Figs. 1 and 4.

[0037] A writing means **132** for producing written markings (such as a pen head with ink, a pencil head with pencil lead, a marking head with any type marking dye, etc.), attachable to paper roll dispenser **1** is also illustrated in Figs. 1 and 4, for context. But, it is understood that the use of paper roll dispenser 1 dispensing papers as heretofore described need not necessarily be restricted only to a combination with a writing head **132**. Indeed, any tubular instrument from which one wishes to dispense rolled paper can utilize this disclosure to more effectively dispense said rolled paper, and all such combinations of the paper roll dispenser **1** disclosed herein with implements that serve purposes and objects other than writing and marking are considered to be within the scope of this disclosure and its associated claims. This includes, but is not limited to: pointers, flashlights, thermometers, measuring implements, and other implements. This also includes a simple paper dispenser **1** standing alone that is uncombined with any other implement.

[0038] Figs. 6-13 illustrate yet another embodiment of the invention which averts the need for the tack adhesive means **108** from the embodiment of Figs. 1-3 or the tearable lines **402** from the embodiment of Figs. 4-5. Fig. 6 illustrates a paper winding core **60** around which paper roll **106** is wound in this embodiment. Paper winding core **60** comprises spindle **116** which is rotated using any suitable rotating means **118** (see Fig. 12) just is in the earlier embodiments, a paper winding region **62**, and a pair of retention cap stops **61** closely outside the edges of paper winding region **62**. Also illustrated is a paper winding slot **63** for receiving the trailing (innermost) edge of paper roll **106** to hold the paper in place during winding and avoid slippage once the paper is wound about paper winding region **62** of paper winding core **60**. Tapes or

adhesives may also be used alternatively to, or to supplement, paper winding slot **63**.As now illustrated in Fig. 7, paper roll **106** is threaded into paper winding slot **63** similarly to how film is wound into a takeup reel when loading film into in a photographic camera, and then wound around paper winding region **62** until taut. Then, cap apertures **72** of pair of flexible paper retention caps **71** are slid over the outer ends of paper winding core **60**. The cap apertures **72** are slightly smaller in diameter than the diameters of retention cap stops **61**, but because paper retention caps **71** comprise a flexible elastomer, they are flexible enough to widen as they are drawn over and past retention cap stops **61**, and to recontract thereafter. In the end, paper retention caps **71** are held in place between the ends of paper roll **106** and retention cap stops **61**, as shown in Fig. 8. Paper retention caps **71** each comprise a securing lip **73** which as shown in Fig. 8 moves over and secures the ends of paper roll **106** in place as shown. As noted, paper retention caps **71** comprise a flexible elastomer. This is an elastomer such as, but not limited to, a flexible rubber or plastic. While not limiting, the elastomer used for paper retention caps **71** should be in the 60A to 95A or 45D to 75D range on the scale customarily used in the art to rate the flexibility of elastomers. Since there is some overlap in these scales, the range is effectively 60A to 75D, and an optimum flexibility is approximately 95A. Elastomers in this range also have a degree of frictional character associated with them, and this frictional character, combined with the capacity the elastomer to set securely over the ends of paper roll **106**, serves to restrain the ends of paper roll **106** and thus maintain paper roll **106** in place as shown in Fig. 8. Note that in this way, paper retention caps **71** serve the same function for restraining the ends of paper roll **106** that was served by the tack adhesive means **108** from the embodiment of Figs. 1-3 and the tearable lines **402** from the embodiment of Figs. 4-5. In suitable configuration, the assembly of paper roll **106** wound about paper winding core **60** and restrained at its ends by paper retention caps **71** can be utilized in connection with the dispenser cases **102** of Figs. 1-5 in the manner

described earlier. But, this assembly is also used in connection with the curl-inducing dispenser case **91** of Figure 9, to be discussed below.

[0039] In the embodiment of Fig. 9, paper roll dispensing aperture **104** is sized and shaped to draw and curl the edges of paper roll **106** inward as paper roll **106** is being dispensed, which in experimental testing has proven to be a very effective approach for dispensing paper. At the outset, it is noted that the length **92** of paper roll dispensing aperture **104** is *smaller* than the length **74** of paper roll **106**. (Note, the cap faces **75** of paper retention caps **71** are regarded to have negligible thickness, which is why reference numeral **74** is shown in both Figs. 7 and 8.) In fact, the outer length **92** of paper roll dispensing aperture **104** is approximately equal to the distance between the inside edges of securing lips **73**, as shown by the reference numeral **92** in both Figs. 8 and 9. Because the length **92** of paper roll dispensing aperture **104** is smaller than the length **74** of paper roll **106**, the edges of paper roll **106** will of necessity be drawn inward into a curl as paper roll **106** is being dispensed; the issue now becomes one of properly controlling this curl.

[0040] There are several elements in the configuration of curl-inducing dispenser case **91** which combine to effectively unroll the leading edge of paper roll **106** for dispensing, and to bring about a suitable curling of paper roll **106** as it is being dispensed. Fig. 10, which shows a cross section of Fig. 9 along the view **10—10**, illustrates a restraining edge **126** of outer winding separation and inner winding restraint means **122**, just as in the earlier embodiments of Figs. 1-5. However, in this embodiment, tension-supplying means **124** is *not* necessary, and outer winding separation and inner winding restraint means **122** does *not* need to flex inward toward the rotational axis **114** as the paper supply is depleted. Instead, restraining edge **126** is fixed in position, and it is the curling of paper roll **106** which keeps the paper properly-situated for dispensing at all times. Referring to all of Figs. 9-11, paper roll dispensing aperture **104** comprises a lateral paper drawing angle **93** for drawing the

paper inward as paper roll **106** is forwardly rotated within curl-inducing dispenser case **91**. Paper roll dispensing aperture **104** further comprises a horizontal curl-inducing angle **94** larger (more inwardly-oriented) than and adjacent to lateral paper drawing angle **93**. Paper roll dispensing aperture **104** further comprises a curl-inducing vertical elevation **95** which is best seen by cross-referencing Fig. 9 with the **10—10** cross section of Fig. 10 and the **11—11** cross section of Fig. 11. Finally, paper roll dispensing aperture **104** further comprises a vertical curl-inducing angle **111** which is visible in the **11—11** cross section of Fig. 11. As lateral paper drawing angle **93** and horizontal curl-inducing angle **94** and the smaller length of **92** of paper roll dispensing aperture **104** compared to the larger length **74** of paper roll **106** draw the paper inward and induce a curl in the paper horizontally (laterally and inwardly) with respect to the plane of the paper by inducing the side ends of paper roll **106** to move laterally and inwardly with respect to a plane of the paper, simultaneously, vertical elevation **95** and vertical curl-inducing angle **111** induce a curl in the paper vertically (perpendicularly and upwardly) with respect to the plane of the paper by inducing the middle of the paper to move upwardly while allowing the side ends of the paper roll **106** to lag.

[0041]

All of these features combine to produce a suitable curling as illustrated in Figs. 12 and 13. In particular, the paper roll assembly **8** of Fig. 8 is inserted into curl-inducing dispenser case **91** through a suitable passageway in the left side of curl-inducing dispenser case **91**. As in the previous embodiments, spindle **116** – which passes through a paper winding aperture **96** – is rotated by engaging any suitable rotating means **118**, with writing means **132** also suitably-mated to paper roll dispenser **1** as previously discussed. Note the support aperture **121** engaging and supporting the left end of paper winding core **60** leaving it free to rotate. If only forward motion is desired, a ratcheting or similar one-way mechanism to prevent paper from being rolled back into the writing implement once it has been unrolled can be employed as

well proximate support aperture **121**, as discussed previously.

[0042] Once everything is assembled as in Fig. 12 with the leading edge **110** of paper roll **106** engaging restraining edge **126** (which in this embodiment serves to peel away leading edge **110**), the paper roll is rotated in a forward dispensing direction. As stated above, lateral paper drawing angle **93** and horizontal curl-inducing angle **94** and the shorter length of **92** of paper roll dispensing aperture **104** compared to the longer length **74** of paper roll **106** draw the paper inward and induce a curl in the paper horizontally (laterally and inwardly) with respect to the plane of the paper by inducing the side ends of paper roll **106** to move laterally and inwardly with respect to a plane of the paper, while simultaneously, vertical elevation **95** and vertical curl-inducing angle **111** induce a curl in the paper vertically (perpendicularly and upwardly) with respect to the plane of the paper by inducing the middle of the paper to move upwardly while allowing the side ends of the paper roll **106** to lag. That is, a curl is simultaneously induced laterally and inwardly with respect to the plane of the paper, and also perpendicularly and upwardly with respect to the plane of the paper. As the paper passes through paper roll dispensing aperture **104**, the paper curls with an inverted end-hook cross-section **123** shown in Fig. 12 and shown separately in Fig. 13 for clearer illustration. As the leading edge **110** of paper roll **106** moves out away from paper roll dispensing aperture **104**, it forms into the wide inverted-v cross section **131**. The v-junction at **132** creates a "tenting" effect, and serves to stabilize the paper as it is dispensed. When a desired length of paper has been dispensed, this desired length is severed from paper roll **106** by tearing against a cutting edge **130**, just as in the previous embodiments.

[0043] While only certain preferred features of the invention have been illustrated and described, many modifications and changes will occur to those skilled in the art. It is, therefore, to be understood that the appended claims are intended to cover all such modifications and changes as fall within the true spirit of the invention.